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ABSTRACT

The implementation of a plus/minus system of grading to replace the traditional A through F grading system for graduate students was studied at a midsize Midwestern university. Decimal equivalents were established to enable the computation of grade point averages (GPAs) that reflected the dispersion of grades through the plus/minus system. A survey was administered to graduate faculty to assess their perceptions of the effect of the plus/minus system on graduate grades, and the analysis was based on 250 responses. Then an analysis of the graduate GPA in the first three graduate courses for 4,944 master's level students who were enrolled under the A-F system was compared to that for 3,144 students enrolled after the implementation of the plus/minus system. Students perceptions before the implementation of the system held a measure of truth in that GPAs did decline, especially in some academic areas. The most conspicuous decline was in the number of "A" grades awarded. Faculty perceptions of the effects of the plus/minus system varied by academic area, with sharp differences among faculty in different disciplines. Faculty members did not tend to think that the plus/minus grading system helped the weaker students, but they did think that the stronger students got higher grades as a result of the new system. Implementing the new system was expensive in terms of dollars and work hours. Overall, data point to clear differences in grading philosophies among the academic disciplines. An appendix contains three tables of average cumulative graduate GPAs. (Contains 8 tables, 4 figures, and 27 references.) (SLD)

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Introduction

The fair and accurate assessment of student performance is an integral part of teaching, and faculty should take this responsibility seriously. Grading and evaluation practices should be based on sound academic principles. Principles used to guide the process include consistency, uniformity, fairness and accuracy; however, as a matter of necessity, grading practices must include provisions for administrative convenience. If assessment of student performance is done well, it is a labor intensive and arduous process. The construction and grading of tests and other student work can be a growth facilitating experience for the student, yet it is an aspect of teaching that has great variability. It is also the area of teaching that contains the greatest potential for conflict between teacher and student.

Grading philosophies are predicated upon three standards: improvement throughout the course, mastery relative to an absolute skill or knowledge standard, and mastery relative to others. Precise terminology that reflects these three standards represents a great challenge. What does an "A" mean and how does it differ from a "B?" Or, what are the criteria for a "Pass" as opposed to a "Fail" or "No Credit?" In any grading system the person who is responsible for assigning the grade faces the proposition that in one type of system, such as the A, B, C, D, or F system, he/she might have more opportunities for error, but the error, if made, would in effect have less impact. In another system, such as Pass/Fail, there would be fewer opportunities for error, but if an error were made, it would have much more impact. Such a proposition is undesirable, yet it is at the heart of the dilemma of assigning grades (Academic Senate, 1996).

Grades tend to support student motivation and success (Ebel, 1974; Eiszler, 1983; Lunneborg, 1977; Stallings & Leslie, 1970; Warren, 1975). Clark (1969) explored the single factor of competition for grades as a source of motivation and found that performance among graduate students significantly increased under conditions when the students were expected to compete for grades. Eiszler agreed but added that grades were perceived to be more valuable and important when individual achievement was determined by standards of mastery rather than against the performance of other students. Likewise, in using the plus/minus grading system, it is extremely important for students who are highly motivated and high performance oriented to see rewards reflected in their grades. Conversely, students who have less motivation should also see consequences reflected in their grades.

Plus/Minus Rationale

Colleges and universities that utilize four-point undergraduate grading systems are increasingly making those systems more detailed and specific. Quann (1987) raised the expectation that more institutions would implement plus and/or minus grading systems as a response to grade inflation. Cole (1993), Grieves (1982) and Singleton and Smith (1978) pointed to the need for more accurately and specifically reflecting a student's performance. In the 1992 national study, the American Association of Collegiate Registrars and Admissions Officers (AACRAO) presented findings which included Singleton and Smith's (1978) argument that institutions that implemented plus and/or minus grading systems would also help their faculty in awarding more reliable grades of student performance. Students do not score at the mean of each of the letter grades. Instead, students score at the full range of possibilities, and the assignment of a letter grade precludes the faculty member from accurately indicating the students' appropriate score (Academic Senate, 1996). With the existence of inflated grades, the predictive validity of a student's record would be more accurate if the student were evaluated on a plus and/or minus scale. Grade inflation, however, was not expressed as a concern in the AACRAO study and was not a goal associated with the implementation of the plus/minus grading option (AACRAO, 1992).

Trends of assessing student achievement represent a departure from the traditional A, B, C, D, or F grading system. Pass/Fail, Satisfactory or Unsatisfactory, Credit/No Credit and other types of scales have emerged, but one that seems to have increasing implementation is the plus/minus system. This system has emerged out of an imperative that faculty are ethically obliged to ensure consistent, fair, and accurate evaluations of student performance.

In essence, the implementation of the plus/minus grading option allows for communicating better and more accurate information to students about their performance. Such a system of accountability must include qualitative and quantitative academic standards. Accountability is consistent with the rising public and governmental concern about accountability in higher education as financial support for colleges and universities declines and institutions are asked to meet growing demands with fewer resources. The A, B, C, D, or F system is too coarse (Academic Senate, 1996), less precise than a plus/minus system, fails to discriminate between exceptional and average student performance, and promotes the "bunching" and grouping errors of grades (Frankel, 1974; Millman, Slovacek, Kulick, & Mitchell, 1983; Stroup, 1966). Student achievement can differ by nearly 25% and result in the same grade and grade value in computing the cumulative average. Conversely, student achievement may not differ by more than 1% yet result in adjacent grades 25% apart in value for GPA purposes. With the plus/minus grading

option there is greater potential for the evaluation determined by the instructor to be more accurate in the assigned grade (Academic Senate, 1996).

Background of the Study

A midsize Midwestern university with an average undergraduate enrollment of 17,500 and graduate enrollment of 2,600 adopted the plus/minus grading system in 1996. Earlier in 1984 the university had discussed the need for a more flexible grading system and had surveyed the faculty as to various aspects associated with such a change. When the 569 faculty responses were summarized, there was almost equal agreement and disagreement as to retaining the grading system that was in place at the time, i.e., the A, B, C, D, or F scale. Comments against the change ranged from "If it's not broken, don't fix it!" to "Plus/minus is a cop out. Either a student earns an A or it should be a B." Comments in favor of the change emphasized the need for finer distinctions in grading. Most of the faculty who had previous experience with plus/minus elsewhere tended to prefer it. A rather large number of faculty commented that they personally used the plus/minus system in their grading anyway while having to simplify it when turning in official grades (Scarbeck, 1995). Of special interest for this study were the recurring comments that plus/minus appeared more appropriate at the graduate level than at the undergraduate level.

In 1995, the faculty-elected governance body appointed a committee to investigate the potential effects of changing to a plus/minus grading system. Motivation for departing from the A, B, C, D or F system included the rationale that the majority of Indiana institutions and schools in the Mid-America Conference, the athletic conference to which the university under study is a member, used the plus/minus system. The grades committee chair added to the discussion, "This is the plan that is spreading throughout the nation." (Scarbeck, 1995). The discussion also included the rationale that the plus/minus system would include more than twice as many grades as before, but there would not necessarily be a greater span among final grades in a class.

Student input into the discussion included concerns that the plus/minus grading system would hurt some students. With the addition of the A- option, the student representative on the governance committee expressed apprehension that professors would award fewer "As" and thus have the effect of bringing down a student's GPA. "Without the counterbalancing effect of an A+ the effect of more A- grades would be adverse for students trying to enter professional schools such as law and medicine." The student representative went on to say that the students she had spoken with about the plus/minus grading system opposed it (Scarbeck, 1995).

The chair of the University Senate, to which the academic governance body reported, offered further procedural clarification. She indicated that the plus/minus system would be announced at a Senate meeting but

would not be submitted to a vote. The chair explained that when the Senate assigned the task to the three-person committee to finalize the plus/minus plan, it also delegated authority to the faculty governance committee for approval of the plan. The Senate chair also indicated that the university president had agreed to submit the concept of plus/minus grading to the university's Board of Trustees for approval (Scarbeck, 1995). The Board subsequently sanctioned the change.

The transition from the traditional A-F grading system to the plus/minus grading system entailed other changes. In order to compute grade point averages that reflected the dispersion of grades via the plus/minus system, decimal equivalents were established. The decimal equivalents that accompanied the recommendation of the plus/minus grading system were as follows:

	A = 4.00	A- = 3.667
B+ = 3.333	B = 3.00	B- = 2.667
C+ = 2.333	C = 2.00	C- = 1.667
D+ = 1.333	D = 1.00	D- = .667
	F = 0.00	

The recommendation for awarding a decimal equivalent of 4.333 for an A+ was defeated because it "would throw off the whole four-point system" (Scarbeck, 1995).

The 1992 AACRAO study confirmed the increasing use of the plus/minus grading system. From 1982 to 1992 the number of institutions adopting the plus/minus grading system increased by 12%. Survey results indicated that ninety-one percent of the respondents who had made substantive changes noted the addition of the plus/minus scale to their letter grade systems. On the other hand, while 97% of the responding institutions used some form of letter grading, only 35.6% used both plusses and minuses (Riley, Checca, Singer, & Worthington, 1994).

Problem and Significance of the Study

While much has been written in general about grading practices in post-baccalaureate education, information documenting the effects of changing from the A, B, C, D, or F grading system to a plus/minus grading system at the graduate level is sparse. Most research studies have emphasized the effects of the implementation of the plus/minus grading system on undergraduate grade point average (UGPA), with grade inflation as the central theme. These studies produced diverse results. Some investigators found the use of plusses and minuses corresponded closely with a rise in UGPA (Juola, 1980; Millman, et al., 1983). Other researchers found that the plus/minus grading system lowered UGPA and could be used to control grade inflation (Hendrickson, 1976; Philbrick & O'Donnell, 1968; Stroup, 1966). Quann (1987) said, however, the plus/minus scale would check grade inflation only if the "A+" grade did not receive more quality points than an "A" grade. However, regarding grade inflation, the few

available investigations at the graduate level have shown that grade inflation patterns, while existing at the higher level, are different from patterns at the undergraduate level (Carney, Isakson, & Ellwsorth, 1978; Juola, 1980).

The impact of changing to the plus/minus system begs investigation. The university under study has utilized the system since 1996. Advantages of the plus/minus grading system are supported by anecdotal information, but little to no empirical research has been undertaken to determine its effects on graduate grades. Information regarding the effect of the system on computed graduate grade point average (GGPA), on faculty assignment of grades, or the discernment among faculty as to the precision of their assessment of student achievement, progress, or rank in class is needed. What impact has the system had on cumulative grade point averages of graduate students? Has the impact, if any, been more pronounced in some programs than others? What is the perception of graduate students toward the system? Have faculty used the system? An investigation of the four years of data that exist might very well provide answers to these pertinent questions.

When a university changes its grading system, the effects of such a change can be far reaching. The previous questions as well as the formal research questions that follow served to frame and focus the study.

Research Questions

1. Do the graduate faculty use the plus/minus grading system?
2. Has the plus/minus grading system affected the cumulative grade point average of graduate students in comparison to the cumulative grade point average of graduate students prior to its adoption?
3. Does the effect of the plus/minus grading system on cumulative grade point average differ among academic graduate programs?
4. Does the effect of the plus/minus grading system differ among graduate students when their cumulative undergraduate grade point averages are compared?
5. Is graduate faculty perception of the effect of the plus/minus grading system in agreement with the actual grades assigned?
6. Does graduate faculty perception of the effect of plus/minus grading system differ by academic disciplines?
7. Do graduate faculty perceive the plus/minus grading system as promoting student learning and motivation?
8. Does the plus/minus grading system allow graduate faculty to improve the accuracy of assessing graduate student achievement?
9. Is the use of the plus/minus grading system influenced by departmental graduate admissions standards?
10. Are the graduate faculty aware of the plus/minus decimal equivalents that are used in computing GPA?

11. How do graduate faculty perceive student attitudes toward the plus/minus grading system in individual graduate departments.

Procedures and Methodology

This study was conducted in two phases. First, a survey instrument was administered to the graduate faculty to assess their perceptions of the effect of the plus/minus grading system on graduate grades. Second, an analysis of the graduate grade point average (GGPA) in the first three graduate courses for master's level students who were enrolled under the A-F letter grade system was compared to students who were enrolled after the implementation of the plus/minus grading system. The choice for three classes was based on previous research (Kingston, 1985; Nelson and Nelson, 1995; Rhodes, 1994; Thompson & Kobrak, 1983; Vaseleck, 1994) that indicated no significant difference in the grade point average in the student's first nine semester hours or first year of graduate study and the student's grade point average at the completion of the graduate course of study. Master's level students were chosen because they have historically represented the largest group of graduate students (approximately 70%) at the institution under study.

A three-way analysis of variance was performed on the nine-hour GGPA with the following factors: academic area, type of grading system, and undergraduate performance (UGPA). Academic area consisted of nine general areas in which masters degrees were sought: applied sciences, architecture, business, communication sciences, education, humanities and arts, life sciences, physical sciences, and psychology. These groupings were similar to the categories used by Educational Testing Service in analysis of GRE scores (Educational Testing Service, 1999) and also followed the college organizational lines at the university under study. The type of grading system was either the A-F letter grade system or the plus/minus grading system. Cumulative UGPAs were categorized into three groups: above 3.5, above 3.0 and below 3.5, and below 3.0.

Survey Instrument

The survey instrument consisted of 34 items. Development of the instrument involved several iterations to provide precise language that eliminated ambiguous statements. A faculty member knowledgeable in survey research critiqued the instrument for clarity and purpose. The instrument was then administered to selected faculty who had expertise in psychometrics. The suggestions from this latter group were then incorporated into the final version that was administered to the graduate faculty.

The types of survey items were broken down as follows: 1) twenty-one Likert scale items the responses from which to choose were "Strongly Agree" (SA), "Agree" (A), "No Opinion" (N), "Disagree" (D), and "Strongly

Disagree" (SD); 2) eight items requiring "Yes" or "No" responses; and, 3) four demographic type items, e.g., the identification of academic rank, years of service at the university, and academic discipline. Two additional items requested the respondents to indicate the level of their use of the plus/minus grading system and the trend of grade changes and appeals they had experienced since the addition of plusses and minuses to the grading scale.

The Likert scale items were subjected to a principal axis factor analysis followed by an oblique rotation to see if certain items could be grouped together. From the factors that emerged from this process factor scores were calculated. An analysis of variance was used to determine if factor scores differed by academic area. The ANOVA was also used to examine whether or not the length of service at the university in the study made a difference in the responses to the survey items.

Population

Surveys were sent to the university faculty who taught graduate courses. Determining the specific number of faculty who taught graduate courses was a complicated process since most of the faculty taught a combination of graduate and undergraduate courses. Faculty who taught undergraduate courses *only* were not included in the study. Originally, 632 surveys were sent to the faculty through campus mail. Thirty were either returned or eliminated for various reasons, e.g., the faculty member was no longer with the university or was on academic leave. Completed surveys were received from 273 faculty members for a return rate of 45%. Surveys from 23 individuals who taught undergraduate courses *only* were excluded from the investigation, leaving the responses of 250 faculty available for analysis.

Data were analyzed for 8,088 master's level students who completed at least three graduate courses with a minimum GGPA of at least 1.0. Grades below 1.0 were excluded from the study to eliminate data of students who had abandoned classes. This prevented skewing of the data and represented the effect of the type of grading system employed on actual grades earned in courses. Cumulative grade averages were available for 4,944 students enrolled under the A-F letter grade system between 1990 and 1995, and for 3,144 students enrolled after implementation of the plus/minus grading system from 1996 through the summer of 2000.

Analysis of Data

Survey and Grade Distribution Results

Analysis of the data is presented by the individual research questions that guided the study. The data are presented from each of the two data sources: the survey data and analysis of grades that been awarded to 8,088

master's level students. In some cases research questions have been combined to allow the reader to view the data from more than one perspective.

Research Question #1. Do the graduate faculty use the plus/minus grading system?

On the survey, the graduate faculty were asked how much they used the plus/minus grading system. Table 1 shows the responses of the faculty by degree of use, faculty rank, number of years at the institution studied, and academic area.

Table 1

Faculty Responses by Percentage of the Use of the Plus/Minus Grading System by Academic Rank, Years of Service at the University, and Academic Area

	Never Use	Use Occasionally	Use Considerably
Assistant Professor	1.8	10.7	87.5
Associate Professor	3.9	17.9	78.2
Full Professor	6.4	23.6	70.0
1-4 Years at University	4.9	9.8	85.3
5-9 Years at University	0.0	16.7	83.3
10-14 Years at University	7.0	16.3	76.7
15+ Years at University	5.5	24.8	69.7
Applied Sciences	0.0	20.7	79.3
Architecture	0.0	0.0	100.0
Business	25.0	43.7	31.3
Communication Sciences	0.0	16.7	83.3
Education	3.1	21.9	75.0
Humanities/Arts	1.7	10.2	88.1
Life Sciences	3.6	25.0	71.4
Physical Sciences	12.0	16.0	72.0
Psychology	12.0	16.0	72.0
All Faculty	4.4	18.9	76.7

Use of the plus/minus grading system varied according to years of experience, faculty rank, and academic discipline. Faculty rank and years of experience at the institution studied were inversely related to the percentage of those who utilized the plus/minus grading system. The new grading scale was used at a lower percentage the higher the academic rank and the number of years of experience of the faculty. Variations in the degree of use were also seen between academic disciplines.

Research Questions #2 and 3. Has the plus/minus grading system affected the cumulative grade point average of graduate students in comparison to the cumulative grade point average of graduate students prior to its adoption? Does the effect of the plus/minus grading system on cumulative grade point average differ among academic programs?

Grade point averages were compared for students before and after the adoption of the plus/minus grading system for the period 1990 through 1999. The results of the comparison are shown in Table 2.

Table 2

Average Cumulative GGPA of Master's Level Students Upon Completion of the First Nine Hours Graduate Hours

	1990 N=842	1991 N=880	1992 N=936	1993 N=911	1994 N=754	1995 N=621	1996 N=903	1997 N=782	1998 N=793	1999 N=666
Applied Sci	3.66	3.68	3.62	3.68	3.66	3.70	3.71	3.72	3.72	3.69
Architecture	3.45	3.57	3.58	3.60	3.54	3.62	3.50	3.54	3.37	3.54
Business	3.39	3.31	3.40	3.37	3.40	3.51	3.38	3.49	3.49	3.63
Comm Sci	3.55	3.53	3.49	3.46	3.54	3.44	3.52	3.56	3.33	3.48
Education	3.81	3.78	3.78	3.83	3.85	3.83	3.72	3.77	3.76	3.79
Hum/Arts	3.68	3.61	3.66	3.67	3.67	3.68	3.60	3.67	3.58	3.56
Life Sci	3.68	3.69	3.57	3.61	3.67	3.66	3.71	3.70	3.68	3.68
Physical Sci	3.65	3.56	3.73	3.63	3.72	3.69	3.61	3.62	3.51	3.61
Psychology	3.62	3.66	3.84	3.74	3.72	3.83	3.83	3.84	3.72	3.68
All	3.64	3.62	3.64	3.63	3.66	3.66	3.64	3.67	3.60	3.63

The key to interpreting the data in Table 2 is to observe the changes before and after 1996 when the plus/minus grading system was implemented. Overall, no significant change was noted; however, in some disciplines, slight declines can be observed. The differences in the grade point averages generally show a downward pattern. Interestingly, this was one of the reasons students opposed adopting of the plus/minus grading system.

While the cumulative GGPA has not changed dramatically since the adoption of the plus/minus grading system, the number of "A" grades has decreased significantly. Table 3 shows the decrease in the assignment of "A" reflected in the first nine hours of graduate study.

Table 3

Percentage of All "A" Grades in the First Nine Hours of Graduate Courses

	1990 N=842	1991 N=880	1992 N=936	1993 N=911	1994 N=754	1995 N=621	1996 N=903	1997 N=782	1998 N=793	1999 N=666
Applied Sci	43.3	50.1	39.6	40.6	41.4	38.5	29.1	31.4	26.0	27.2
Architecture	28.6	24.2	18.6	19.2	25.0	32.3	8.8	11.1	10.3	3.1
Business	16.1	8.5	16.0	21.8	21.1	18.8	8.1	9.1	13.2	27.7
Comm Sci	26.6	21.4	18.6	21.6	32.3	19.8	9.4	14.3	5.7	7.6
Education	61.2	58.2	52.6	66.4	64.8	61.2	31.3	30.5	29.8	38.1
Hum/Arts	44.1	37.1	47.4	45.3	39.3	44.2	16.7	25.3	14.3	16.4
Life Sci	41.0	46.8	38.2	33.9	43.6	39.4	37.9	34.5	30.1	37.2
Physical Sci	43.1	43.1	48.1	42.4	44.2	42.1	36.3	23.1	16.3	33.3
Psychology	41.3	39.4	61.3	46.2	60.3	62.5	36.5	36.8	31.7	26.3
All	41.2	39.4	40.2	40.7	42.7	40.5	25.6	25.6	21.1	25.3

As indicated earlier, grades in graduate school usually fall into the "A" and "B" range with a few "Cs". Table 3 depicts the percentage of "A" grades before and after the change to the new grading system. While all academic disciplines showed a decrease in the percentage of "A" grades awarded when plusses and minuses were employed, a particularly sharp contrast was evident in the fields of education and the humanities and the arts between 1995 and 1996. Again, student concerns that fewer "As" would be granted were supported by the data. Too, while the percentage of "A" grades in many areas has rebounded slightly since 1996, although not to the pre-1996 levels, only in psychology and architecture did the awarding of "As" continue a consistently downward trend.

Research Question #4. Does the effect of the plus/minus grading system differ among graduate students when categorized by cumulative undergraduate grade point average?

The three categories into which records were placed to address this question depended upon the students' cumulative UGPAs. Based on the concept that stronger academic students earn higher undergraduate grades, the data were divided into clusters representative of the students' achievement at the baccalaureate level. The divisions were UGPAs above 3.5, above 3.0 and below 3.5, and below 3.0. The impact of the plus/minus grading system on each category of academic accomplishment is shown in Table 4 below.

Table 4

Comparison of 9-hr GGPA Before and After Implementation of the Plus/minus Grading System

	Before Plus/Minus				After Plus/Minus			
		UGPA				UGPA		
Area	All	≥ 3.5	3.0-3.5	< 3.0	All	≥ 3.5	3.0-3.5	< 3.0
Applied Sci	3.66	3.75	3.69	3.62	3.71	3.87	3.74	3.61
Architecture	3.57	3.78	3.60	3.45	3.51	3.64	3.57	3.36
Business	3.38	3.57	3.38	3.28	3.49	3.68	3.51	3.36
Comm Sci	3.50	3.70	3.56	3.39	3.47	3.71	3.53	3.34
Education	3.81	3.93	3.84	3.72	3.75	3.88	3.79	3.64
Hum/Arts	3.66	3.82	3.68	3.51	3.60	3.81	3.53	3.51
Life Sci	3.64	3.82	3.65	3.47	3.69	3.85	3.71	3.50
Phys Sci	3.67	3.82	3.68	3.58	3.58	3.81	3.62	3.41
Psychology	3.74	3.82	3.74	3.56	3.76	3.84	3.71	3.70
All	3.64	3.80	3.66	3.53	3.64	3.81	3.67	3.49

Table 4 displays average cumulative GGPAs before and after the plus/minus grading system was adopted. Average cumulative GGPAs were computed for the nine academic areas for the years 1990-1995 and 1996-2000 and divided into the categories discussed above. Very little change is noted in the overall GGPAs; however, slight variations can be seen between and within academic areas when comparing the two grading systems. The better the undergraduate performance, the better the grades earned in graduate courses. However, the overall nine-hour GGPA for the three groups was almost the same for each type of grading scale. Less variation in GGPA was observed for those students whose UGPAs were above 3.0 and less than 3.5 than for the stronger academic group. And, for the weakest students, i.e., those whose UGPAs were lower than 3.0, graduate grades dropped after the new grading scale was utilized, especially between the years 1995 and 1996. It is noteworthy, too, that for some academic areas, the nine-hour GGPA was better for the plus/minus scale than for the A-F scale, while for other areas, the opposite was true. Complete data for the three groups, displayed by year and academic area, are found in Appendix A.

The analysis of variance on the means given in Table 4 produced the results displayed in Table 5 below.

Table 5

Analysis of Variance of GPA by Area, Grading System, and Performance

Sources of variation	Sum of Squares	Degrees of freedom	Mean square	F	Sig.
Area	89.637	8	11.205	79.703	.000
Grading system	.688	1	.688	4.895	.027
Performance	62.619	2	31.309	222.718	.000
Area by System	6.035	8	.754	5.366	.000
Area by Performance	3.235	16	.202	1.438	.114
System by Performance	.131	2	.066	.467	.627
Area by System by Perf.	2.717	16	.170	1.208	.252
Within cells	990.096	7043	.141		

While the three main effects were significant, a significant interaction occurred between the type of grading system and the area of study. This interaction was not surprising, given the means presented in Table 4. In some areas, the GGPA improved after implementation of the plus/minus system. In other areas, the GGPA decreased. Therefore, an analysis of the simple effects for the differences in the nine-hour GGPA between the types of grading systems for each area was conducted. The results are shown in Table 6 below.

Table 6

Analysis of Simple Effects

Area	Mean Square	df	F
Appl. Sciences	.834	1	5.910*
Architecture	.363	1	2.570
Business	2.443	1	17.326**
Communication Science	.870	1	6.170*
Education	.728	1	5.160*
Humanities/Arts	.775	1	5.500*
Life Sciences	.222	1	1.575
Physical Sciences	1.267	1	9.050**
Psychology	.012	1	.090
Within cells	.141	7043	

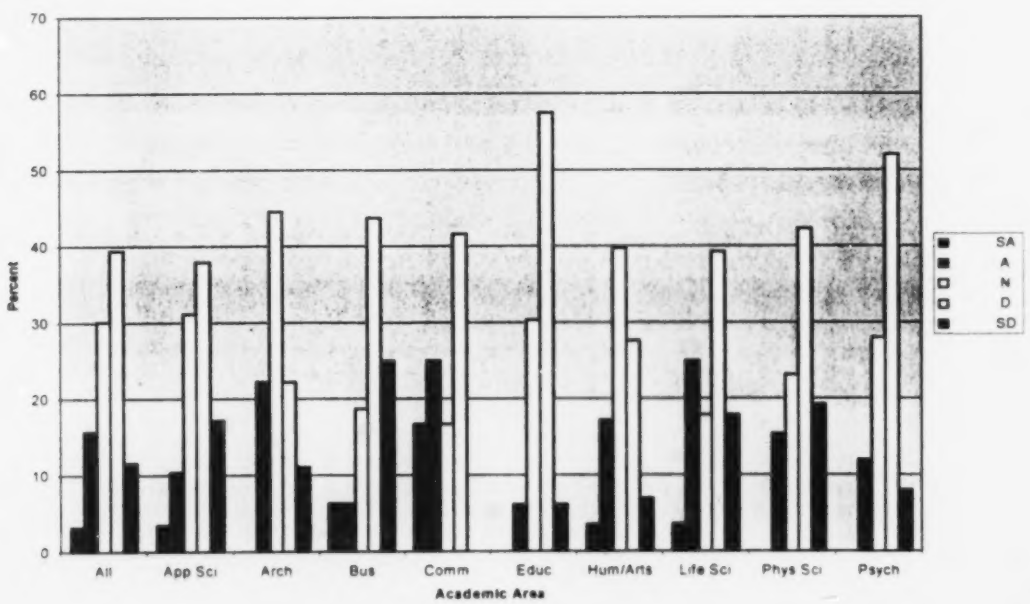
*Significant at .05
**Significant at .01

One may conclude that the change in the grading system from the A-F scale to the plus/minus scale was different for different academic areas. The GGPA in the business area improved when the plus/minus scale was implemented. The GGPA decreased in applied sciences, communication sciences, education, humanities/arts, and psychology.

Research Questions #5 and 6. Is graduate faculty perception of the effect of the plus/minus grading system in agreement with the actual grades assigned? Does graduate faculty perception of the effect of the plus/minus grading system differ by academic disciplines?

Faculty responses to five specific items on the survey were compared with the actual grades that were assigned. Faculty responses showed variation between those items, and not all responses from individual academic areas agreed with the overall results. Collective opinion disclosed that faculty tended to disagree with the item "The plus/minus grading system helps the weaker student." When disaggregated by academic area, however, the survey results demonstrated that faculty in architecture, communication sciences, humanities and arts, and life sciences perceived the plus/minus grading system as helping students whose UGPAs were low. Figure 1 illustrates those findings.

Figure 1. Faculty Responses to the Item "The Plus/Minus Grading System Helps the Weaker Student."

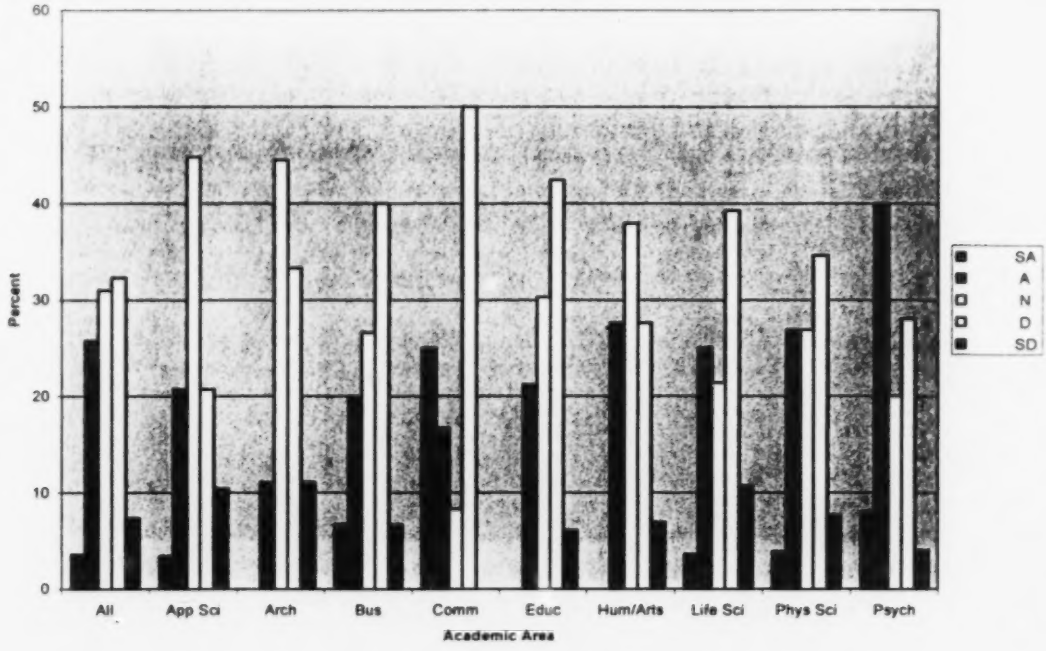


Actual data confirmed faculty perceptions in that GGPAs of the weakest category of students (UGPAs < 3.0) declined slightly after the plus/minus grading system was implemented (see Table 4). Again, results fluctuated by

academic area. Only grades in business, life sciences, and psychology showed improvement with the new grading scale.

Generally speaking, faculty disagreed with the item "Grades are lower as a result of the plus/minus grading system," although responses were widely dispersed. Only in psychology did faculty indicate concurrence on this item. Results are shown in Figure 2.

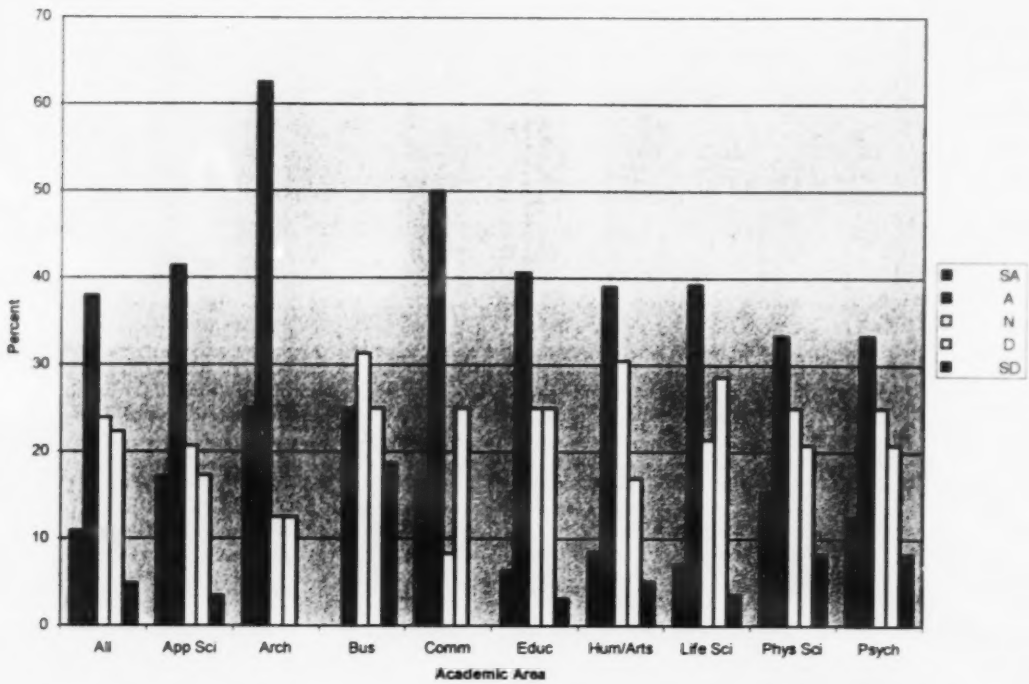
Figure 2. Faculty Responses to the item "Grades are Lower as a Result of the Plus/Minus Grading System."



Grade analysis did not support faculty perceptions. Cumulative GGPA did not change with the addition of plusses and minuses, but in architecture, business, communication sciences, education, humanities and arts, and physical sciences grades did decline. Interestingly, grades in psychology rose slightly after 1996, in contrast to faculty opinion in that discipline (see Table 4).

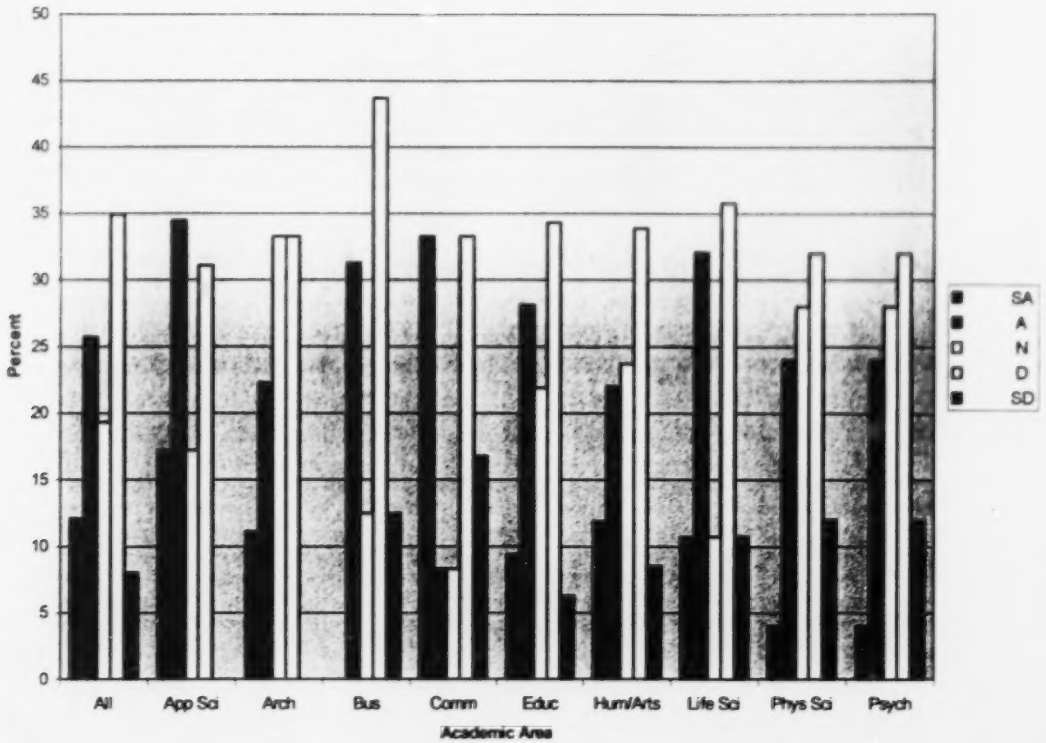
Faculty concurred most strongly on the item that the plus/minus grading system helped borderline students, i.e., students whose evaluation fell between two grades on the A, B, C, D, or F grading scale. Considerable agreement (over 40%) was evident in all academic areas except business, where only 25% concurred. Figure 3 illustrates those findings.

Figure 3. Faculty Responses to the item "The Plus/Minus Grading System Helps Borderline Students."



Survey results showed that faculty thought stronger academic students received higher grades on the plus/minus grading scale. Faculty in business, communication sciences, education, humanities and arts, physical sciences, and psychology, however, disagreed, while faculty in architecture and the life sciences were equally divided. Results are shown in Figure 4.

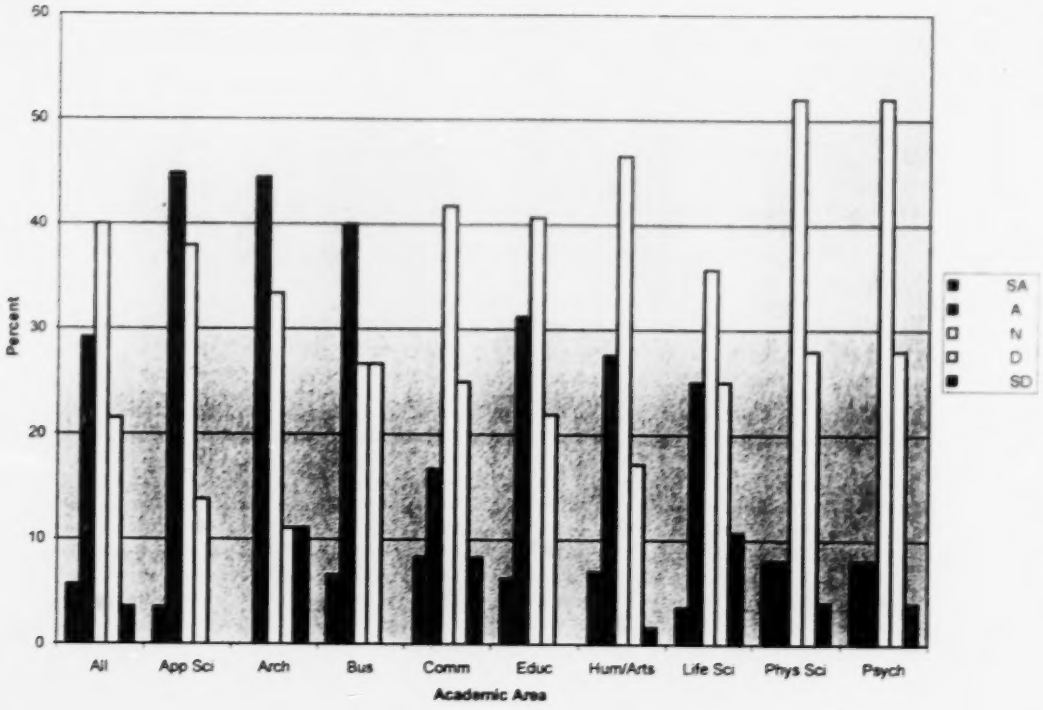
Figure 4. Faculty Responses to the item "Higher Grades are Awarded to Stronger Academic Students on the Plus/Minus Grading System."



Data analysis generally supported faculty perception on this item. Although overall, cumulative GGPAs of students in the highest academic category, defined as UGPAs 3.5 and above, remained virtually constant under the two grading systems, graduate grades in most academic areas improved slightly under the plus/minus grading system. Exceptions were grades in architecture and education (see Table 4).

Faculty responses were widely dispersed on the item "The plus/minus grading system has not affected grade inflation." Most of the faculty agreed, though not overwhelmingly, that the plus/minus grading system had not affected grade inflation. However, responses from faculty in communication sciences, life sciences, physical sciences, and psychology indicated that grade inflation was indeed affected by the new grading scale. Faculty perceptions on this item are shown in Figure 5.

Figure 5. Faculty Responses to the item "The Plus/Minus Grading System has not Affected Grade Inflation."

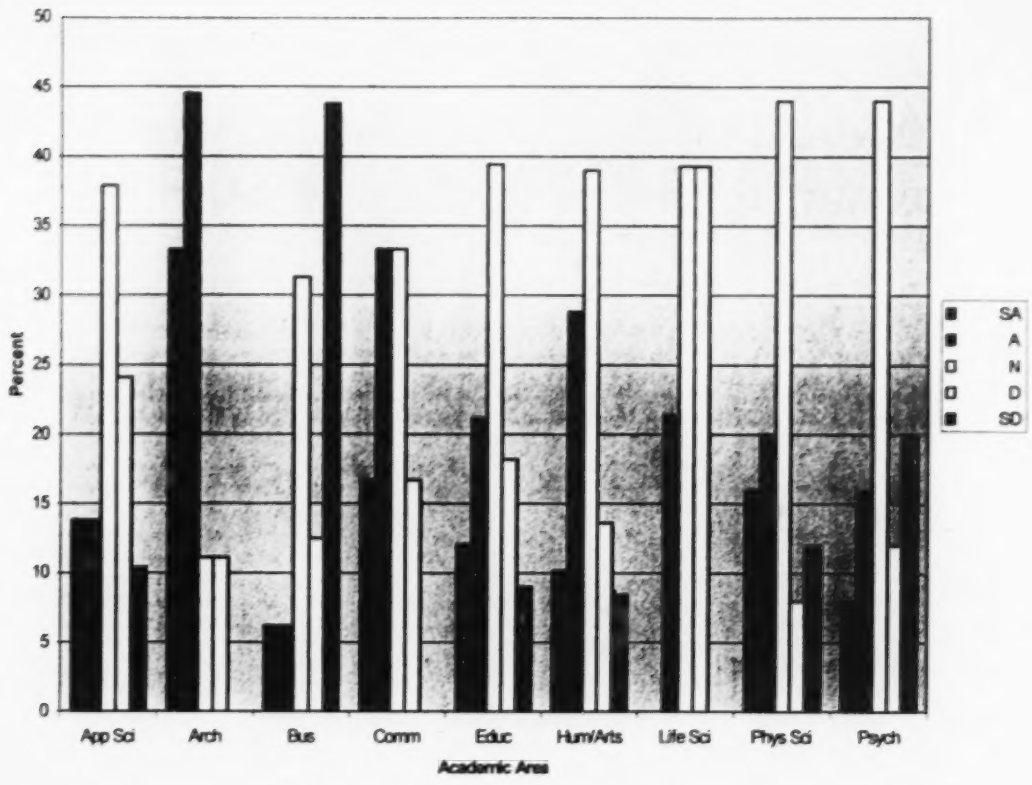


Grade data disaggregated by year and academic discipline showed only slight changes in GGPA over the last ten years. Thus, grade inflation, defined here as a sustained rise in GGPA, was not perceived to have been a problem (see Table 2).

Research Question #7. Do graduate faculty perceive the plus/minus grading system as promoting student learning?

Faculty responses were generally dispersed as to the plus/minus grading system promoting student learning, but, except for faculty in architecture, many expressed no opinion on this item. The general pattern was agreement that the new grading scale encouraged scholarship. Only in applied sciences, business, life sciences, and psychology did faculty opinion indicate that plusses and minuses did not improve learning. The findings are displayed in Figure 6.

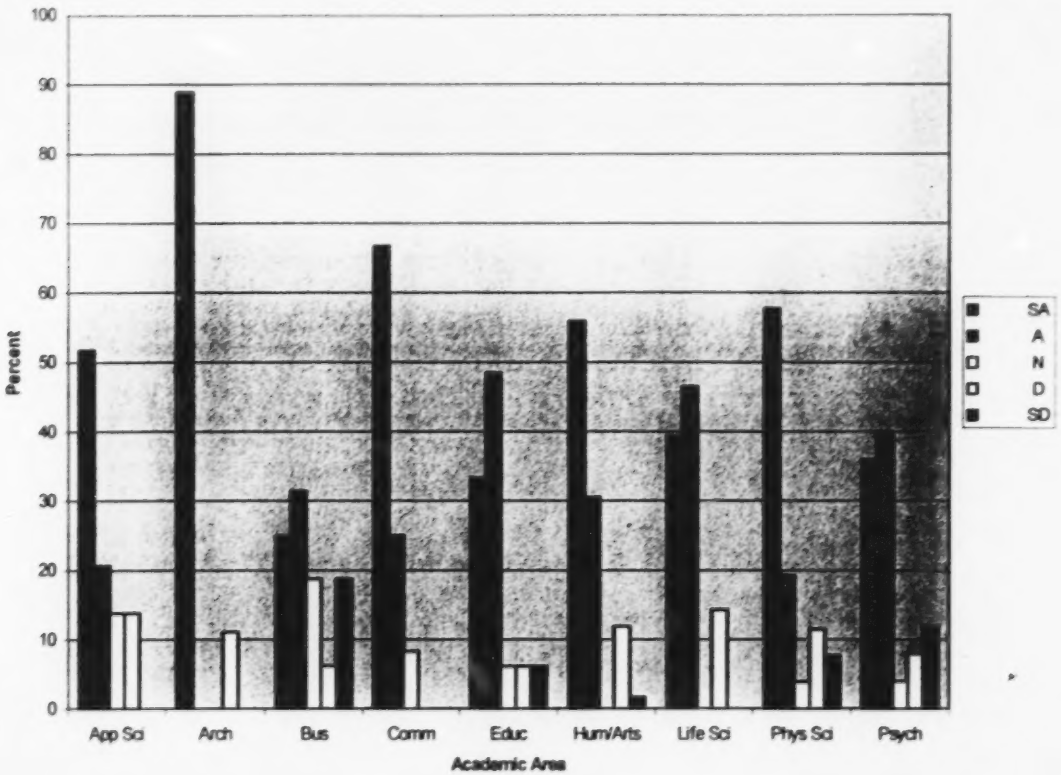
Figure 6. Faculty Responses to the item "The Plus/Minus Grading System Promotes Student Learning."



Research Question #8. Does the plus/minus grading system allow graduate faculty to improve the accuracy of assessing student achievement?

Faculty in all academic areas agreed that the plus/minus grading system improved the accuracy of assessing student performance. Interestingly, the highest percentage of respondents who disagreed with this item were faculty from business; nearly one fourth believed that plusses and minuses did not increase accuracy in assigning grades. Conversely, nearly 90% of the architecture respondents strongly agreed that the new grading scale elevated the precision of evaluating student achievement. Figure 7 illustrates those results.

Figure 7. Faculty Responses to the item "The Plus/Minus Grading System Improves the Accuracy of Assessing Student Performance."



Research Question #9. Is the use of the plus/minus grading system influenced by departmental graduate admissions standards?

Two survey items served to address this question. A majority of the faculty did not perceive a link between graduate admissions standards and the grading system; however, over 25% thought there was a link. A word of explanation is needed here. If grade point average is used as an admission variable, changing the grading system could potentially affect the cumulative grade point average, therefore affecting the cutoff scores that had been established. While 25% of the faculty responding perceived a link between admissions standards and the grading system, less than 10% agreed that admission standards reflected the need for the plus/minus grading system.

Research Question #10. Are the graduate faculty aware of the plus/minus decimal equivalents that are used in computing GGPA?

Computation of grade point averages is not the responsibility of faculty, but it has implications for students in various ways, e.g., rank in class, transfer of grades. When the plus/minus grading system was adopted in 1996, a decimal equivalent system was established to convert grades into cumulative grade point averages. Faculty tended to be unaware of the decimal equivalent system (79.9%) after plusses and minuses were added. In addition, only 16.3% of the respondents indicated they included the decimal equivalents on their syllabi.

Research Question #11. How do graduate faculty perceive student attitudes toward the plus/minus grading system in individual graduate departments?

Faculty responses to the item on the survey indicated that faculty simply did not know how students felt about the grading system (77%). Perhaps this item might become a catalyst for faculty to discuss the grading scale more systematically with students.

Principal Axis Factor Analysis of the Survey Instrument

A principal axis factor analysis was performed on the 21 Likert items of the questionnaire. Seven factors were extracted, which accounted for 64% of the variance. An oblique rotation was performed and this resulted in the loadings for the first four factors displayed in Table 10.

Table 7

Factor Loadings for the 21 Likert Items

Item	Factor 1	Factor 2	Factor 3	Factor 4
1	.66	-.01	-.03	-.12
2	.58	-.02	.11	-.27
3	.81	-.04	-.03	-.13
4	.84	.00	-.08	-.13
5	.01	.76	-.04	-.14
6	.09	.10	.13	-.42
7	.04	.12	-.68	.04
8	-.57	.18	.00	.06
9	-.31	.62	-.10	.12
10	.66	-.03	-.11	-.08
11	.48	.17	.27	-.06
12	.04	.04	-.03	-.84
13	.41	.05	-.04	-.15
14	-.08	-.17	-.20	-.20
15	.03	.07	.06	.04
16	.02	.07	.05	.05
17	.62	-.04	.02	.10
18	.38	-.06	.09	.05
19	.00	.33	.04	.04
20	.18	.04	.09	.00
21	-.08	.03	.12	.03

Examination of the loadings and the direction of the loadings in Table 10 showed that Factor 1 seemed to represent the appropriateness of the plus/minus grading system for graduate work. The loadings on Factor 2 reflected the views of those who felt that a plus/minus system was inappropriate for graduate work. The relatively high negative loading of Question #7 on Factor 3 indicated a viewpoint that the plus/minus grading system was not perceived as a lowering of grades. The high negative loading of Question #12 on Factor 4 represented a perception that the plus/minus grading system was of no help to borderline students.

From the factor scores produced by the 21 survey items, an 8 by 2 analysis of variance was performed on the first four factor scores for each respondent, where the respondents were categorized by discipline (for this part of the analysis, architecture was considered an applied science) and length of time at the university (fewer than 10 years, 10 years or more). The results of the analyses of variance are presented in Table 11.

Table 8

Analyses of Variance of Factor Scores

Sources of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F	Sig
Factor 1					
Academic Discipline	13.189	7	1.884	2.181	.037
Length of Service	2.710	1	2.710	3.137	.078
Discipline by Service	10.953	7	1.565	1.811	.086
Residual	190.062	220	.864		
Factor 2					
Academic Discipline	6.759	7	.966	1.260	.271
Length of Service	.046	1	.046	.060	.807
Discipline by Service	2.710	7	.387	.505	.830
Residual	168.507	220	.766		
Factor 3					
Academic Discipline	2.596	7	.371	.684	.688
Length of Service	8.757	1	8.757	16.084	.000
Discipline by Service	1.884	7	.269	.494	.838
Residual	119.787	220	.544		
Factor 4					
Academic Discipline	11.566	7	1.652	2.263	.030
Length of Service	.037	1	.037	.029	.647
Discipline by Service	3.726	7	.532	.729	.647
Residual	160.607	220	.730		

It is noteworthy that for the scores of Factor 1 and Factor 4, the area of the respondent was significant, but not the length of service. For Factor 3, the length of service of the respondent was significant, but not the academic area. Factor 2 did not yield any significant differences either between the academic area of the respondent or the length of service of the respondent.

Therefore, the perception of the appropriateness of the plus/minus grading system varied among academic disciplines. The perception of the effect of the plus/minus grading system as a deterrent to grade inflation varied by the length of service of the respondent, but was not affected by discipline.

Discussion and Conclusions

Implementing a new grading system holds the potential for change. The impact may be real or perceived. Whether real or not, perception is often reality to those doing the perceiving. In the case of the plus/minus grading system discussed in this study, student perception held a measure of truth. Grade point averages did decline, especially in some academic areas. Faculty opinion prior to the implementation of the plus/minus grading system indicated that this new scale appeared more appropriate at the graduate level than at the undergraduate level. After four years of using plusses and minuses in the grading process, faculty continued to support this concept. Faculty perception in some cases reflected an attitude of "another innovation, so what?" In other cases faculty felt strongly that the plus/minus grading system held an advantage in that it enabled them to be more precise in assigning grades. Younger faculty tended to use the new system more than older faculty. Faculty who were lower ranked tended to use the plus/minus system more.

Grades in graduate school usually have a very narrow range. The objective of grades should be to provide an indication of the learning that has taken place. In this study a wide variation of grades that were assigned within academic areas and among academic areas leads to the conclusion that grades have very different meanings and purposes for faculty who assign them. When one is interested in a more analytical discernment, the plus/minus grading system offers more options. When one uses a more holistic approach, the plus/minus still contains the A-F options.

Faculty perceptions as to the effects of the plus/minus grading system varied by academic area. Sharp differences were noted on some survey items between faculty perceptions from one academic area to another. The raw data showed that faculty tended to agree most on the plus/minus grading system helping borderline students. However, interpretation of this item apparently referred to students who were between grades, not in danger of failing, because the factor analysis revealed the perception that the plus/minus grading system was of no help to borderline students. Faculty did not think the plus/minus grading system helped the weaker student, but did think that stronger students got higher grades as a result of the new system.

Graduate student grades changed immediately after the plus/minus grading system was adopted. Grades were lower in 1996 from the previous year under the A-F grading system. However, the decrease changed, and only a slight decrease was recorded overall. Fewer "A" grades were awarded initially after the change, particularly in education and the humanities and the arts, and while the number of "A" grades has rebounded, it has not reached the

pre-1996 level. The pattern of fewer "A" grades has remained in a consistently downward pattern in psychology and architecture.

The cost of implementing a new grading system is expensive. The estimates in this study, 70,000 in actual dollars, and over 600 work hours for conversion, may be conservative when one considers the changes in computer programs, forms and administrative procedures that were needed to implement the change. No data were available regarding the training of personnel to make the change.

Determining the effect of the implementation of a plus/minus grading system from a traditional A-F grading system is a complex task. Cumulative grades evaluated overall showed only a slight drop and not enough to sustain the initial anxiety of the students. The most significant change with the addition of plusses and minuses was the precipitous drop in the number of "A" grades assigned. However, it is important to keep in mind that most of the student apprehension at the university studied reflected the potential effect of grades assigned in undergraduate courses, not at the post-baccalaureate level.

The data and faculty survey pointed to a clear difference in grading philosophies among the academic disciplines. Institutions considering the addition of plusses and minuses to their grading systems would do well to evaluate the existing grading practices of each academic discipline. Analysis of actual grades assigned in addition to student and faculty surveys concerning the meaning of grades and how they are assigned will better prepare institutions for possible ramifications of such a policy change.

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Appendix A

Table A1

Average Cumulative GGPA of Master's Level Students Upon Completion of the First Nine Graduate Hours Whose Undergraduate Graduate Point Average was 3.5 and Above

	1990 N=156	1991 N=165	1992 N=182	1993 N=205	1994 N=165	1995 N=155	1996 N=190	1997 N=181	1998 N=167	1999 N=164
Applied Sci	3.69	3.92	3.71	3.82	3.65	3.72	3.91	3.88	3.85	3.85
Architecture	3.50	3.88	3.50	3.81	3.80	3.83	3.65	3.47	3.79	3.76
Business	3.48	3.58	3.58	3.65	3.57	3.62	3.75	3.54	3.68	3.77
Comm Sci	3.72	3.77	3.69	3.74	3.60	3.78	3.83	3.80	3.57	3.62
Education	3.89	3.98	3.96	3.92	3.96	3.87	3.89	3.88	3.84	3.89
Hum/Arts	3.86	3.79	3.82	3.81	3.79	3.82	3.78	3.85	3.76	3.87
Life Sci	3.85	4.00	3.84	3.73	3.91	3.76	3.90	3.77	3.80	3.91
Physical Sci	3.86	3.74	3.88	3.87	3.83	3.76	3.92	3.81	3.77	3.72
Psychology	3.68	3.75	3.88	3.80	3.80	3.93	3.88	3.87	3.78	3.83
All	3.75	3.83	3.82	3.80	3.78	3.81	3.85	3.80	3.77	3.81

Table A2

Average Cumulative GGPA of Master's Level Students Upon Completion of the First Nine Graduate Hours Whose Undergraduate Graduate Point Average was Between 3.0 and 3.5

	1990 N=322	1991 N=328	1992 N=375	1993 N=352	1994 N=302	1995 N=250	1996 N=336	1997 N=321	1998 N=296	1999 N=270
Applied Sci	3.64	3.71	3.75	3.64	3.72	3.69	3.76	3.77	3.70	3.74
Architecture	3.46	3.69	3.62	3.60	3.54	3.57	3.53	3.63	3.64	3.56
Business	3.36	3.32	3.35	3.34	3.49	3.45	3.30	3.49	3.61	3.68
Comm Sci	3.66	3.60	3.45	3.50	3.60	3.62	3.62	3.59	3.41	3.53
Education	3.89	3.80	3.80	3.88	3.86	3.82	3.74	3.78	3.81	3.87
Hum/Arts	3.67	3.58	3.80	3.64	3.65	3.72	3.53	3.61	3.50	3.46
Life Sci	3.69	3.68	3.66	3.56	3.70	3.67	3.71	3.75	3.71	3.64
Physical Sci	3.63	3.70	3.73	3.73	3.71	3.63	3.68	3.58	3.54	3.69
Psychology	3.67	3.66	3.87	3.67	3.81	3.80	3.78	3.80	3.72	3.59
All	3.65	3.66	3.67	3.63	3.69	3.68	3.67	3.70	3.65	3.65

THE PLUS/MINUS GRADING INVENTORY

Please respond to the following items concerning the plus/minus grading system by drawing a circle around the answer of your choice. Your participation is completely voluntary and you are free to discontinue the survey at any time.

SA = Strongly Agree A = Agree N = Neutral D = Disagree SD = Strongly Disagree

1. The plus/minus grading system promotes student learning.	SA	A	N	D	SD
2. Regardless of academic discipline, the more rigorous the course the more appropriate the plus/minus grading system.	SA	A	N	D	SD
3. The plus/minus grading system increases the precision of assessing student achievement more accurately than the A, B, C, D, and F system.	SA	A	N	D	SD
4. The plus/minus grading system is appropriate for my academic discipline.	SA	A	N	D	SD
5. The plus/minus grading system is more appropriate for undergraduate courses than graduate courses in my discipline.	SA	A	N	D	SD
6. The plus/minus grading system helps the weaker student.	SA	A	N	D	SD
7. Grades in graduate courses are lower as a result of the plus/minus grading system.	SA	A	N	D	SD
8. In assigning grades with the plus/minus grading system, I find it difficult to distinguish between letter grades, e.g., B+ and A-.	SA	A	N	D	SD
9. Only letter grades of A, B, and C are needed in graduate school.	SA	A	N	D	SD
10. The plus/minus grading system encourages students to work harder, e.g., to earn an A rather than an A-, B+ rather than B.	SA	A	N	D	SD
11. The plus/minus grading system really makes no difference in the way I assign grades in graduate courses.	SA	A	N	D	SD
12. The plus/minus grading system helps students who are borderline between letter grades.	SA	A	N	D	SD
13. As a result of the plus/minus grading system, higher grades are awarded to stronger academic students.	SA	A	N	D	SD
14. Grades are a function of the interaction of faculty expectations and academic ability of the student.	SA	A	N	D	SD
15. Grades are a function of the interaction of faculty expectations and student characteristics other than academic ability, e.g., attendance, attitude.	SA	A	N	D	SD
16. Grades in graduate courses should reflect student achievement rather than student rank in class.	SA	A	N	D	SD
17. Graduate admission standards in my department reflect the need for the plus/minus grading system.	SA	A	N	D	SD
18. Graduate students in my department like the plus/minus grading system.	SA	A	N	D	SD
19. Grades in graduate school should indicate the completion of courses rather than their use as an evaluative tool.	SA	A	N	D	SD
20. The plus/minus grading system has not affected grade inflation.	SA	A	N	D	SD

over 30

21. Graduate admission standards and the grading system are not linked in my department. SA A N D SD

22. I understand the decimal equivalents to the letter grades in the plus/minus grading system, e.g., B+ = 3.33. Yes No Uncertain

23. In my syllabi, I convey to my graduate students the decimal equivalents to the letter grades in the plus/minus grading system. Yes No Uncertain

24. My decision to use the plus/minus grading system is influenced by student opinion. Yes No

25. In assigning grades I use the plus/minus grading system to indicate improvement in student learning/achievement. Yes No Uncertain

26. My awarding of a grade with a plus or minus is influenced by the effect it will have on the student's cumulative grade point average. Yes No Uncertain

27. I have had experience in assigning grades with the A, B, C, D, and F system without plusses and minuses. Yes No

28. The number of grade changes and appeals I have personally experienced as a result of using the plus/minus grading system has: (circle one)

increased considerably
increased slightly
stayed the same
decreased slightly
decreased considerably

29. Most universities accept for transfer credit only those courses in which a grade of B (3.0) or better was assigned. It would influence my awarding of a grade of B- in a graduate course if I knew the course credit would not transfer to another institution. Yes No Uncertain

30. Which one of the following options best describes your use of the plus/minus grading system? (circle one)

I never use the plus/minus system.
I use the plus/minus system occasionally.
I use the plus/minus system considerably.

Please complete the following demographic information.

31. Academic Area (circle one: see back of cover letter for description of areas): Applied Sciences, Architecture, Business, Communication Sciences, Education, Humanities/Arts, Life Sciences, Physical Sciences, Psychology

32. Number of years employed as faculty at BSU (circle one): 1-4 5-9 10-14 15 or more

33. Academic rank (circle one): Instructor
Assistant Professor
Associate Professor
Full Professor

34. I teach (circle one): graduate courses only
undergraduate courses only
both undergraduate and graduate courses

Please add any comments or suggestions you think might help us in conducting our project on the back of this survey.

Thank you for taking time to complete this survey!

Table A3

Average Cumulative GGPA of Master's Level Students Upon Completion of the First Nine Graduate Hours

Whose Undergraduate Graduate Point Average was Below 3.0

	1990 N=335	1991 N=371	1992 N=364	1993 N=342	1994 N=260	1995 N=194	1996 N=341	1997 N=250	1998 N=287	1999 N=181
Applied Sci	3.66	3.59	3.51	3.67	3.64	3.69	3.61	3.56	3.69	3.55
Architecture	3.45	3.40	3.53	3.42	3.31	3.54	3.35	3.55	3.22	3.41
Business	3.36	3.20	3.38	3.21	3.20	3.54	3.35	3.43	3.28	3.39
Comm Sci	3.42	3.41	3.47	3.37	3.42	3.26	3.38	3.42	3.21	3.35
Education	3.72	3.68	3.70	3.75	3.74	3.81	3.59	3.67	3.66	3.64
Hum/Arts	3.52	3.51	3.42	3.57	3.63	3.43	3.46	3.62	3.54	3.40
Life Sci	3.52	3.56	3.35	3.55	3.44	3.43	3.54	3.53	3.52	3.25
Physical Sci	3.61	3.32	3.67	3.50	3.71	3.62	3.38	3.53	3.38	3.36
Psychology	3.43	3.49	3.63	3.79	3.33	3.69	3.72	3.84	3.62	3.69
All	3.56	3.50	3.53	3.55	3.54	3.51	3.48	3.55	3.48	3.46